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EDITORIAL.

Professor Gallie.

It was with great pleasure that all those interested in the Faculty of Medicine, and particularly the students, received the news that Dr. W. C. Gallie had accepted the position of Professor of Surgery in the University of Toronto. The late Professor C. L. Starr, by his ability and energy raised the University of Toronto to an enviable place in the world of surgery, and his untimely death left a vacancy which could only be filled by a man of the most exceptional merit. In our opinion the University has found that man.

During the time that he was Surgeon-in-Chief to the Hospital for Sick Children, Professor Gallie attained an international reputation for the originality and precision of his work. At the same time the excellence of his lectures and clinics has made him a favorite with the students. That combination of ability as a surgeon and ability as a teacher will make for great success as Professor of Surgery.

The Value of Writing.

There are various methods which may be used to gain mastery over a subject. First of all comes reading, the more complete the better, and then discussion and writing. To quote Bacon, "Reading maketh a full man, conference a ready man, and writing an

exact man And, therefore, if a man write little, he had need have a great memory." Since this exactness is the quality which is so essential for the medical man, writing is of especial value for him, and many students make use of it in preparing for examinations, in the form of a synopsis of the work to be covered. The fault is that for a big subject, too much time is consumed.

Another method is the writing of a paper. This brings one into contact with the most intimate details of a subject—there is no better way to gain a knowledge of it. Best of all is to write on original work, but since that is not always possible, especially for students, the more usual course is to scan the current scientific literature on the subject and give a critical summary of it. In addition to the actual knowledge gained there is developed scientific judgment, which is so valuable for the medical man. The various results and theories must be weighed, their worth appraised, and a degree of scepticism developed. In this day of faddism and hasty publication of results, conservative judgment is an asset.

The reading of literature preliminary to the writing of a paper is stimulating. Text books must of necessity be dogmatic and consider a subject in an orderly fashion, and lay down axioms. Constant reading of such works may tend toward a passive acceptance and a parrot-like memorization of the material without a real understanding of the principles.

On the other hand, when one explores the outskirts of knowledge where experimentors are feeling their way, nothing is dogmatic and results must be considered in a logical way and argued to a conclusion. In later years the memory retains those things which have been thought out rather than those which have been memorized.

Lastly, there is a very definite manner in which a scientific paper should be written and proficiency can only be obtained by practice. Many medical men are called upon to present a paper before some meeting or to contribute to a journal, and if they have never written a paper before, unexpected difficulties may arise. The logical time to begin is during undergraduate days, and in that way proficiency is attained and an assurance gained which may be of great help in future years.

The Secretion of Gastric Juice.

By N. B. TAYLOR, M.B., F.R.S.C. (Edin.),
Associate Professor of Physiology.

Without going into the histological details of the gastric glands, a few points may be referred to very briefly. The cells composing the tubules are of three main types and each of these has its own special characters and functions. One type is responsible for the secretion of pepsin, another for the formation of the acid, while the third type is mucoid in character. The glands of the fundus and body of the stomach contain all three classes of cells. The cells of the pyloric glands are entirely of the mucoid type and secretion of this portion of the stomach, on this account, is slightly alkaline and is composed chiefly of mucus, though it also contains small amounts of a weak proteolytic ferment.

The Formation of Hydrochloric Acid.

Probably the most interesting constituent of the gastric juice is the hydrochloric acid, which is secreted by the oxyntic or parietal cells of the glands of the fundus and body of the stomach. Ever since Prout first demonstrated the presence of hydrochloric acid in gastric juice the production of this strong mineral acid in such high concentration (.4 to .5%) by the gland cells has aroused the curiosity and wonder of physiologists. It is a remarkable phenomenon. The only parallel cases of a strong acid being formed by living processes is the production of sulphuric acid, probably for defence purposes, by certain molluscs, and the presence of fluid of a PH as low as I.O in the vacuoles of some unicellular organisms. It is to be expected that the fact would have aroused the curiosity of the great French physiologist, Claude Bernard. Indeed, it strained his credulity, for he doubted at first the correctness of Prout's observation. Subsequently, however, becoming convinced of its truth, he set himself the task of discovering the precise point where the acid was formed. With this end in view he injected potassium ferrocyanide and lactate of iron into the veins of an animal. These substances give the Prussian blue reaction in the presence of free mineral acid. The mucosa of the stomach was turned blue after the injection, but no discolouration occurred in the gland cells or the lumen of the gland. He, therefore, concluded that the glands secreted an innocuous antecedent material which, upon reaching the surface of the mucosa, gave rise to the acid. This experiment was repeated by Macallum and Fitzgerald at Toronto in a modified form, but with contrary results. The Prussian blue reaction was detected within the fine intracellular canaliculi. The question was not allowed to rest here, for Harvey and Bensley, by the use of vital dyes which changed colour at definite PH values, reverted to the original view of Claude Bernard. Recently, however, Ivy, by means of a Pavlov pouch and the use af vital dye indicators, has demonstrated that during secretion the cells have a PH ranging somewhere between 6.8 and 3.0. A more precise value was not able to be determined, but it shows that the site of acid formation is definitely intracellular. It is to be expected that the acid would not be permitted to accumulate, but would be carried away as soon as it was formed.

The chemical processes concerned in the manufacture of the acid has also been a subject of speculation and experimentation. The ultimate source of the acid is undoubtedly the sodium chloride of the blood. Voit and Kahn showed many years ago that if an animal be fed for some weeks upon meat

deprived of its chlorides by prolonged boiling in distilled water, acid-free gastric juice was secreted. The addition by others of bromides and iodides to the food in place of chlorides resulted in the secretion of hydrobromic acid in the former and to a lesser extent hydriodic in the latter instance. Also it has been shown that a fall in blood chlorides occurs during gastric digestion.

A weak acid may react with a stable salt and produce large quantities of a strong acid provided that the latter diffuses rapidly from the site of its production. The chemical reaction responsible for the formation of hydrochloric acid was believed by Maly to be one of this nature. He thought that the acid was formed by the parietal cells through the action of monosodium phosphate upon sodium chloride according to the following equation:

$$Nacl + NaH_2PO_4 = Na_2HPO_4 + Hcl.$$

Indeed a better explanation of the formation of the acid cannot be given to-day and Collip by microchemical methods has obtained important evidence in its support. This observer finds the parietal cells to be exceptionally rich in phosphates, but during rest the chlorides are absent. When the glands become active, however, there is a remarkable increase in the cell chlorides. How the rapid diffusion of chlorides into the cell is brought about during glandular activity is a mystery common to the problem of secretion in general. At any rate these experiments show that the chemical elements necessary for the production of hydrochloric acid are brought into intimate relationship and apparently in abundance during glandular excitation.

It is to be expected that the drain of hydrogen ions would tend to upset the acid-base balance of the blood. That this is so, and that readjustment occurs to maintain the normal blood PH has been shown by the observations of Dodds and Bennett. During gastric digestion the respirations are depressed and there is a retention of carbon dioxide as shown by a rise of several millimeters in the tension of this gas in the alveolar air. The excretion of acid by the kidney is also reduced, a greater proportion of the alkaline phosphate being passed in the urine, which may be but slightly acid or even alkaline in reaction. In instances of complete absence of gastric secretion (achylia) this so-called "alkaline tide" in the urine does not occur after a meal, nor is there a rise in the alveolar CO_2 tension. In hypersecretion the respiratory and urinary responses are exaggerated.

The Mechanisms of Gastric Secretion.

It has been known for many years that it is not a necessary condition for the stimulation of the gastric glands that food shall enter the stomach. The mere presence of food in the mouth will cause an abundant secretion of gastric juice. The flow which occurs under these circumstances is brought about reflexly and is termed the *psychic secretion.* It is also well known that the glands are excited by the presence of food within the stomach after all nerves connecting the viscus with the central nervous system have been severed. The secretion under these circumstances obviously cannot be the result of a central reflex. It must be due either to a local reflex mediated through the nerve plexuses in the gastric wall itself, or to some mechanism that is essentially different in nature from the nervous type. This phase of the secretion may, for the lack of a better name, be termed the *secondary secretion,* or the *secretion of juice in the presence of food.*

(a) *The psychic secretion.* This has been studied in detail upon dogs by Pavlov, who through the unique methods devised by him, has been eminently successful in solving many problems of gastric secretion. In order that normal gastric juice might be obtained during digestion and uncontaminated by food, a portion of the stomach with its blood and nerve supply intact was partitioned off from the main cavity. This *miniature stomach* portrayed the behaviour

of the main stomach under different experimental conditions. For the study of psychic secretion the animal was "sham fed," that is, the oesophagus was divided in the neck and the lower end of the proximal segment of the sectioned tube was brought out through the neck-wound and stitched in position. An animal prepared in this way can eat and enjoy its food. This does not enter the stomach after being swallowed, but issues from the oesophageal opening. The animal eats with relish, and yet, since its appetite suffers no appeasement "sham feeding" may be continued for any length of time. In some experiments in which it was kept up for from 5 to 6 hours as much as 700 ca.c. of pure gastric juice was secreted into the main stomach. Even after a single 5-minute period of sham feeding the secretion persisted for from one to three hours, and produced two or three hundred c.c. of juice. Division of the vagi completely abolishes the response, it is therefore without doubt due to a reflex mediated through these nerves. The character and quantity of the juice secreted varies with different foods, but the only quality of these which influences the response seems to be their palatability, and not their chemical or mechanical properties. Meat for which the animal has a keen relish produces a juice of the greatest abundance and richest in ferment. Bread or other materials not particularly desired cause less secretion and the juice is weaker in digestive power. A more pronounced effect occurs if the animal be hungry. In marked contrast to the activity of the salivary glands, no secretion can be evoked by placing inedible substances in the mouth, or those which are injurious or nauseous, such as acid, pepper, assefetida, etc. Indeed suppression of a pre-existing secretion may be caused by disagreeable stimuli of this nature. All these facts point to the involvement of the higher mental processes in the reflex mechanism. The pleasure of eating, the agreeable stimulation of the organs of taste and the gratification of appetite are essential conditions. It is not necessary even that the food enter the mouth in order to elicit the gastric response. Provided the food is sufficiently appetizing the mere sight or smell of it will cause secretion. In other words, a *conditioned reflex* can be established for gastric as well as for salivary secretion.

That the psychic secretion is not merely a physiological curiosity with little real bearing upon gastric digestion may be judged from the large amounts of juice secreted and also by the fact that digestion in the stomach is very seriously hampered when it does not occur. When, for instance, a piece of meat or bread is placed in the stomach through a fistula while the animal is asleep or has had its attention diverted and is unaware that the food has been introduced, only a quarter as much of the food undergoes digestion as when the animal has been first shown the morsel or has been "sham fed" previously.

Some believe that Pavlov has over emphasized the importance of the psychic secretion, so far at any rate as human digestion is concerned. But long ago Richet observed that in a subject who had suffered oesophageal stricture, and into whose stomach an opening had been made for feeding purposes, a secretion of gastric juice occurred upon the entrance of food into the mouth. Within recent years Carlson has carried out extended observations upon a subject who had a similar operation performed as a result of closure of the oesophagus following the ingestion of a corrosive in childhood. All the findings of Pavlov were in the main confirmed in the case of this man. The influence of appetite or the desire for food was particularly well brought out. The subject always especially enjoyed the desert, and the curve of gastric secretion showed the most pronounced rise when fruit, such as oranges, or when sweets were chewed. The secretion, however, did not endure for as long as in Pavlov's experiments and commenced to decline as soon as the stimulation of the taste buds had ceased. Nor did the sight or smell of food evoke a response,

except when in one instance the subject was sent from the laboratory to choose his meal from a near-by cafeteria. In this case there was a very definite response to the sight and smell of the food. Several other observers have reported the occurrence of conditioned reflexes in the mechanism of gastric secretion in man. Rehfuss et al investigated this subject in normal men by means of gastric analyses. It was found that the secretion of juice was decidedly less if the food was unappetizing. This was especially so if its appearance and the environment of the meal were unenticing. Offensive odours were particularly prone to depress the secretion.

All these facts have their obvious applications to dietetics. Food agreeable to the palate and attractive in appearance, impressions received from a meal that has been prepared in a pleasing way, and probably also, sensations aroused by the surroundings, yet not directly concerned with the food itself, have all an effect upon gastric secretion. The impulse which guides the gourmet is sounder physiologically than that which impells the glutton. The question of calories and of the relative digestibilities of the different food stuffs must not be allowed to obscure the psychic element entirely in these matters, for the "delights of the table" have true digestive value. These facts are expressed in the phrase of Pavlov's "appetite spells gastric juice," or in the hospitable words of Macbeth, "Let good digestion wait on appetite and health on both." Custom seems to have discerned this truth, for it has decreed that the meal shall commence and end with the more strongly flavoured and appetizing morsels.

(b) *The secretion of gastric juice in the presence of food.* The secretion of appetite juice ceases after from one to three hours in the dog, and after a shorter time in man. There has never been any question, however, but that gastric secretion continues for a much longer period under ordinary circumstances, that is, when food enters the stomach and undergoes digestion. How is this secondary secretion accomplished? In the first place, what is the adequate stimulus for secretion? Is it a mechanical or a chemical one? Though Pavlov believed that a mechanical stimulus was totally incapable of exciting the glands, Ivy and Farrell recently have shown that distension of the stomach causes a slight flow of juice after a comparatively long latent period. But this fails to explain the great secretion which occurs in the presence of food. Pavlov showed that the extractives of meat and vegtables and the split products of protein digestion were the effective stimulants. The question naturally arose, how do these substances act? They might conceivably do so (1) by stimulating the gland cells directly; (2) by their absorption and carriage to the gland cells in the blood stream; (3) by the stimulation of afferent nerves in the mucosa and thus bringing about secretion through a central reflex, or (4) through the local nerve plexus, or finally (5) by the production of a hormone in the gastric mucosa. The first three of these possibilities are ruled out and the fourth rendered improbable by the following facts: Excitation of the glands of the miniature stomach occurs when the stimulating substances are placed in the main stomach; injection of the materials directly into the blood stream causes no secretogogue effect; the secretion occurs after the stomach has been isolated from the central nervous system.

The Gastrin Theory.

In 1902 Bayliss and Starling discovered a hormone in the upper part of the small intestine which had a very powerful effect upon the secretion of pancreatic juice. (They thought that the hydrochloric acid of the gastric juice was responsible for its formation, but Mellanby has shown recently that the bile acid is the effective agent in this mechanism). The discovery of this substance led Edkins a few years later to search for one of similar nature which might be concerned in the control of gastric secretion. He found that

when the pyloric mucosa was ground up with some of the stimulating substances, notably peptones, glucose, etc., and extracted, the extract had a powerful secretory effect when injected intravenously. A simple watery extract was ineffective. Injection of the substances themselves directly into the blood stream was also incapable of causing secretion. The undetermined principle in the active extracts he termed *gastrin*.

Since the experiments of Edkins the specificity of this substance has been seriously questioned. It was claimed that a similar substance could be extracted from many other tissues, duodenum, thyroid, spleen, etc., and that in consequence the secretogogue material which Edkins had obtained from the gastric mucosa was devoid of any physiological significance so far as gastric digestion was concerned. The substance was thought to be similar in nature, though not identical, with histamine.

It has been definitely proved, however, by the work of Ivy and his associates that an excitatory substance is actually carried to the gland cells during digestion. A portion of the fundus was completely isolated from the rest of the stomach and transplanted into the mammary gland of a lactating animal. After the operation, which was performed in three stages, no nervous or direct vascular connections existed between the two portions of the stomach. The transplanted pouch secreted a small amount of fluid continuously when the animal was fasting. This, however, seemed to be the nature of a transudate rather than a true secretion, since it contained no pepsin or free acid. After the animal had been fed and digestion had proceeded in the main stomach for from two to three hours, a well-marked secretion of gastric juice occurred. This could only be explained as being due to the response of the gland cells of the transplant to some blood-borne influence arising as a result of the digestive processes proceeding in the main stomach. Taking previous work in conjunction with this experiment, it seems highly probable that a hormone, as Edkins originally contended, is formed in the mucosa of the stomach during the digestion of a meal.

Variations in Gastric Secretion.

The amount of human gastric juice is subject to wide variations under many conditions which may be considered physiological. In a certain proportion (about 5%) of otherwise perfectly normal individuals there is practically no secretion at any time. In others the secretion is very slight. A pronounced reduction in secretory activity, or even its complete and permanent absence appears to be consistent with perfect health. In old age there is a tendency for the secretion to fail. The secretion of juice may be temporarily depressed by nervous influences. Anxiety, fear, pain and other emotional states depress the activity of the gastric glands. Substances such as meats and vegetables which are rich in extractives have a stimulating effect. Fatty food is inhibitory at first, though a late stimulating effect is said to occur after the fat has entered the duodenum and undergone digestion. Alcohol possesses a secretory effect. Of other medicinals bitters in aqueous solution are without effect, while alkalis if given in large doses depress secretion, though in small doses they are either without any action or slightly stimulating. Acids both organic and inorganic are depressing, and atropine, as one would expect, is a powerful inhibtor of gastric secretion.

Hypersecretion is also of common occurrence and is usually associated with hyperacidity of the gastric contents. A certain proportion of healthy individuals (about 5%) upon analysis of the contents of the stomach show an increased acidity. This does not mean that the juice as it leaves the glands is excessively acid. So far as is known, the juice as it is secreted has never, even in pathological conditions, a greater acid concentration than the

usual figure of from .4 to .5%. The greater acidity of the juice in the cavity of the stomach may be due either to a greater amount secreted and, in consequence, to its greater concentration and its relative freedom from dilution by mucus or ingested fluid, or to the interference with the passage of chyme from the stomach as in pyloric obstruction. The regurgitation of the alkaline duodenal juices through the pylorus has been considered to be the essential mechanism concerned in the reduction of gastric acidity which accurs toward the latter part of normal digestion. Its disturbance was thought to offer a satisfactory explanation of many cases of high gastric acidity. The recent work of Maclean and Griffiths, however, detracts very seriously from the importance of this mechanism in the control of gastric acidity, if indeed it represents a physiological function at all. These observers have shown that the stomach possesses a mechanism of its own by which the acidity of its contents is automatically controlled. When the H ion concentration of the gastric contents rises above a certain optimum value the secretion of acid falls. The gastric glands secrete, instead, a neutral juice rich in chloride (Nacl) which reduces the acidity of the fluid in the stomach by simple dilution aided by the emptying of the organ. The Cl. concentration of the gastric juice remains practically constant at from O.11 to O.12 N. throughout digestion, but at one time more is combined with H' ions (hydrochloric acid) and at others with basic ions (neutral chloride) the proportion of chlorine combined with either ion being adjusted in accordance with the acidity of the stomach contents. The peptic activity was found to run practically parallel with the increase in the neutral chloride.

Hyperacidity per se apparently causes no subjective symptoms of any kind. Histamine, for instance, has an intensely stimulating effect upon secretion. If a small dose of this poison be injected into an individual large quantities of cencentrated gastric juice are secreted within a remarkably short time, yet no gastric sensations are aroused. The ingestion of acid in amounts which raise the acidity of the gastric contents above the values ever encountered in disease, can also be borne without inconvenience.

Though this paper has aimed to deal solely with the secretory processes of gastric digestion, I should like in conclusion to remove the impression that these duties of the stomach are the all important ones. Borelli and the mechanical school of physiologists of the 17th century saw digestion simply as a process in which trituration of the food and the expression of its nutritive juices were the essential elements. Chemical processes were scarcely considered. The second stomach or gizzard of the bird in which resistant objects such as glass beads were crushed, was pointed to in support of their mechanical conceptions of gastric digestion. Not until the experiments of Reaumur and Spallanzani did the chemical character of gastric digestion become clear. They showed by a crucial experiment—the digestion of meat by gastric juice in a test tube—that gastric digestion was a chemical process, and not simply a mechanical disintegration of the food. Ever since their times more stress probably has been laid upon the chemical than upon the mechanical side. There is no doubt, however, that the latter is in reality of just as great importance, perhaps of even greater importance than the chemical factor. Subjects in whom the gastric juice is entirely absent appear to suffer little or no difficulty in the digestion of food. The stomach may be removed, and provided the consistence of the food is made suitable little digestive inconvenience results. Disturbances of gastric motility, on the other hand, the too rapid entrance of or the interference with the passage of material into the duodenum will induce ill effects. The chemical processes of gastric digestion, important as they are, must not be allowed to overshadow in our minds the mechanical factors. A

prime function of the stomach is to prepare the food for intestinal digestion, to break it up, to add fluid to it and after reducing the entire mass to a semi-fluid consistency to pass it on to the duodenum.

Cyanosis of the New Born.

Part I.

Congenital Heart Disease and Intracranial Haemorrhage.

By W. A. HAWK, 3T0.

Foetal Respiration and Circulation.

We are considering the foetus just before birth. Tracing the circulation from the placenta, the oxygenated blood is carried by the umbilical vein to the under side of the liver—here some passes through the portal branches, but the majority directly through the ductus venosus to the inferior vena cava At the right auricle it is reflected by the Eustachian valve through the foramen ovale into the left auricle That blood entering by inferior vena cava passes into the right ventricle, and ultimately into the pulmonary artery. Here a division occurs—the majority passes into the aorta by the ductus arteriosus entering distal to the left subclavian artery—the rest passes through the lung tissue.

This blood entering the left auricle is joined by that pasing through the foramen ovale and is eventually driven into the aorta. It returns to the placenta through the continuation of anterior hypogastric arteries.

There are certain factors to be noted:

(a) There is no true purely arterial blood supplied.

(b) The purest blood passes to the upper extremities and the head, the impure blood which passes through the ductus arteriosus is supplied to the lower extremity.

The foetal lungs are small compact, possessing sharp margins and tending to lie at the posterior part of the pleural cavities. The foetal lung tissue closely resembles glandular tissue—the air spaces are small, circular, lined by a columnar epithelium.

Changes in Circulation and Respiration at Birth.

As soon as the child is born it usually cries loudly and inflates its lungs. Consequently the pulmonary arteries are dilated and the greater portion of the blood from the right ventricle passes through them. There occurs closure of the foramen ovale, ductus arteriosus, ductus venosus and the umbilical vessels. The changes are:

(a) The ductus arteriosus collapses—probably aided by its inherent contractility. The causes may be: (1) Valve like formation at the junction of ductus and aorta now closed by greater pressure in the aorta. (2) The ductus may pierce the aortic wall obliquely—hence increased aortic pressure would close the distal end. (3) Twisting of the duct due to change in position of the heart in relation to the aorta. The walls become thickened, the canal closes. Practical closure occurs at birth, though probably not a complete obliteration for several months.

(b) The foramen ovale is now closed by its thin membranous valve which lies in the left side of the opening. This occurs consequent to cutting off the placental circulation and we find an equalization of pressure in both auricles.

The valve now contracts adhesions with the edge of the aperture. But, however, a partial opening may persist for years.

(c) The walls of the umbilical vein agglutinate and in a few weeks it is transferred into a cord like ligament. Accompanying this is a similar change in the ductus venosus.

(d) The hypogastric arteries contract and thrombose, presupposedly from the fact that the unaided left ventricle can not maintain the circulation through the placenta.

The changes in respiration are:

At birth the lungs normally fill with air—expanding and completely filling the pleural cavities. At first only a small portion of the lung is expanded, the respiratory exchange is small and the respiratory center is less sensitive to stimulation by CO^2 than later. Eventually more and more expansion occurs, within a month or so there is probably complete expansion.

The changes in the lungs are marked—the margins become rounded, the compact foetal tissue becomes light and spongy owing to the enormous increase in the size of the alveola. The sudden influx of blood causes a marked increase in weight.

The mechanism of the change is supposed to be somewhat along these lines: By the action of the muscles of respiration we have an expansion of the chest walls hitherto unexpanded—the diaphragm is drawn down and respiration is now established. After the first few respirations the breathing is chiefly abdominal. Thoracic musculature is not used to any extent during infancy.

Cyanosis of the New Born.

The first thing to be decided is what is meant by "new-born." It is usual to divide paediatrics into several age periods according to the various stages passed through in development.

The period of infancy which is taken to terminate at the close of the first year of life has the first few weeks of life set apart—the "new-born" period of infancy.

On general consideration we lay down the first two or three weeks as the new-born period with the reservation that many children lose early the clinical characteristics of the new-born whilst in others it persists for a much longer time.

Causes of Cyanosis Neonatorum.

According to Hess:

(A) Inherent causes:

1. Lack of development of the C.N.S., especially the respiratory center.
2. Weakness of general musculature and softness of the ribs.
3. Persistence of foetal atalectasis.
4. Congenital malformation of the heart or great vessels.
5. Similar malformation of the respiratory tract or the diaphragm.
6. Disease or compression of the air passages.
7. Injuries of the skull or cerebral haemorrhage.
8. Birth weight below 1200 gms.—almost invariably connected with cyanosis.

(B) Extraneous Causes:

1. Aspiration of food or vomitus into the larynx or trachea.
2. Distension of stomach from overfeeding.
3. Occurrence of general or local infection.

However for practical purposes we take these four main factors:

1. Congenital Heart Disease.
2. Intracranial Haemorrhage.
3. Thymic enlargement.
4. Congenital Atalectasis.

Congenital Heart Disease.

Historically—in the early period of medicine this disease was of interest only to the embryologist and pathologist. Peacock was the first to study in a systematic manner this subject and his clinical treatise published in 1855 was markedly accurate and complete.

The development of the heart is extremely complex—sufficient for our needs are these few facts. It originally consisted of two straight tubes which merged—then we have a change to an S-shaped organ divisible into (a) upper truncus arteriosus; (b) middle ventri-

cular portion; (c) lower venous portion. The changes later occurring are the division of the two sides of the heart by septa-division of pulmonary and aortic arteries and the appearance of valves.

Etiology.

It is chiefly the result of:

(1) Abnormal or arrested development of the heart.

(2) Foetal endocarditis.

Either one may be causative of the same lesion and may be coexistent.

Arguments in favor of the first are the concommittant occurrences of congenital defects—Rokitansky, Peacock, Mueller, etc., point out the accompanying presence of such lesions as microcephalus, hare lip, polydactylism. Vierordt found eight cases of congenital heart disease in four generations of one family.

The cause of cardiac anomalies is according to some authorities to be sought not so much in a hereditary disposition, but in a diseased condition of the foetal envelope in the maternal tissues. Histories of infective processes and depressing influences acting on the parental organism have been found.

Foetal endocarditis was at one time the accepted cause, but now under foetal endocarditis, we include only those cases with thickening and cicatricial contraction. Such cases must be associated with a maternal infection and placental transmission. Such may occur in rheumatic fever—syphylis—possibly some of the viridans infections.

Pathological Physiology and Anatomy.

There is rarely just one lesion—usually we find a multiplicity of lesions and with this a continuous change in the diseased heart. In consequence it is very difficult to state the pathological picture in its entirety.

There are, however, out of the variety of lesions some which occur so frequently as to deserve especial mention. These are:

(A) Due to incomplete closure of areas which should normally be closed at birth.

1. Patent interventricular septum.

In the majority of cases the pressures in the right and left ventricles are not equal; consequently part of the blood is left over in diastole, first in one side and then in the other. This in turn produces dilatation and hypertrophy

2. Patent Foramen Ovale.

In many cases of an uncomplicated ovale no symptoms may occur. In more severe cases in which we have a pulmonary stenosis and unequal auricular pressures we have a continuous flow from one auricle to the other.

3. Patent Ductus Arterosus.

It is nearly always associated with other lesions—particularly pulmonary stenosis. In such cases it relieves the aorta of some of the blood sending it through the lungs.

(B) These due to stenosis of areas which should normally be patent.

1. Pulmonary Stenosis.

This may occur at any point in the artery, it usually produces an increase of pressure in the right ventricle and a decrease in the pulmonary supply. Unrelieved the right ventricle soon becomes dilated and hypertrophied with the consequent tricuspid insufficiency and venous stasis.

However associated lesions come to the association of the overburdened right heart—the foramen ovale is kept open allowing the accumulated blood to flow into the left auricle. The ductus arteriosus may remain patent and portion of aortic blood may be shunted through the lungs.

2. Aortic Stenosis.

3. Mitral Stenosis—these are merely mentioned—being very infrequent.

4. Another lesion which may occur is a transposition of the great vessels—aorta arising from the right ventricle—pulmonary from the left. Of its effects

the most marked is probably a very deep continuous cyanosis.

Frequency.

In an analysis of 850 cases by Maude Abbot—the following incidence is shown:

1. Patent Foramen ovale in 258 cases.
2. Defects of the interventricular septum in 251 cases.
3. Patent ductus arteriosus in 222 cases.
4. Pulmonary stenosis in 130 cases.
5. Pulmonary in 53 cases.
6. Mitral Stenosis in 16 cases.
7. Aortic Stenosis in 11 cases.

Signs and Symptoms.

There are five major signs—cyanosis, dyspnea, polycythaemia, clubbing of the fingers, cardiac murmurs.

(A) Cyanosis.

It is the earliest—most common and constant symptom—it is presnt in about 90% of cases. Its etiology is doubtful. Morgagni and others attribute it to venous congestion—de Senac to mingling of arterial and venous blood. Peacock to deficient areation of the blood.

The theory advanced by de Senac refuted by Peacock can undoubtedly explain some cases. To the contrary it has been repeatedly shown at autopsy that certain cases in which cyanosis is a constant symptom showed no malformation which might allow mingling of the venous and arterial blood. Furthermore cyanosis may be absent in life in cases of "cor biloculate," when there is a complete absence of a ventricular septum.

The theory of venous stasis does not explain the situation completely. We must admit that the right side of the heart usually becomes quickly overburdened with the consequent venous stasis. Cyanosis may be absent in many acquired conditions where stasis is one of the most marked features. It is difficult to understand how a simple venous stasis from pulmonary obstruction could be sufficient to lead to cyanosis, and yet be unassociated with the obdema accompanying the back pressure from other causes.

The theory that a variety of causes including some of these above lead to a deficient aeration of the blood, and that this is the essential element in the production of cyanosis has been formulated by recent observers. We now believe that this is definitely established—the circulation evidently accomodates itself to a certain degree of O_2 unsaturation whether brought about by obstruction—by retardation of the flow or by mingling of arterious and venous blood. We believe that when the deficient oxygenation reaches a certain level this becomes insufficient for the needs of the body and cyanosis results.

Some facts about the cyanosis:

(a) It varies in intensity from purplish to very red.

(b) It usually is most evident in the nose, lips, fingers and toes—later the muscous membranes—the schlera and even the tongue.

(c) It usually occurs after birth to remain through life, occasionally fading with age. However, in some instances it does not occur until later in life.

(d) The symptoms may be absent when the patient is at rest, becoming more intense in excitement and exercise.

(e) It is very severe and permanent in pulmonary stenosis—in other lesions it may not be present.

(B) Dyspnea.

This is not uncommonly associated with cyanosis to an extent dependent upon the degree of cyanosis. In many cases it may even occur only on exertion. It may pass into attacks resulting in unconsciousness, these are more marked in young infants—particuarly when feeding.

(C) Clubbing of the Fingers.

It is an almost constant symptom—resulting from the same changes or cyanosis. It consists of enlargement of the soft parts of the terminal phalanges plus an hourglass curvature of the nails. The

most marked feature is the thickness developing between the nail and finger bed due to marked oedema and coursing through this are new formed capillaries. The probable cause is the stasis and lack of oxygenated blood with the effect of toxins on the tissue.

(D) Polycythaemia.

The blood picture is markedly changed, the Hb index may rise to values of 160%—the red blood cells are increased in some cases being 6,000,000 per cu. mm.

(E) Cardiac Murmurs.

Although the murmurs are most important in the physical diagnosis yet too much value must not be laid on the quality and transmission in the differentiation of the various lesions.

Different lesions give the same murmurs and these become quite complicated through the changes the heart undergoes. However the murmur in congested heart disease are usually distinctive enough to be differentatied from these in acquired cases.

(a) They appear chiefly in the 2, 3 and 4 interspaces with the point of maximum intensity usually at the base of the heart.

(b) They almost always arise from lesions affecting the right side of the heart.

(c) Though the P.M.I. is at base of heart they are well propagated over the whole chest.

(d) They are nearly all systolic in time except patent foramen ovale where it is presystolic and patent ductus where it is continuous with systolic accentuation.

(e) The quality varies from soft blowing to rough machinery murmurs.

(f) They are often accompanied by thrills usually palpable over the whole chest, in contra distinction to acquired thrills which are felt over a limited area only.

(F) Changes in the heart—usually the right side is the first to become enlarged contrary to most acquired lesions.

Praecordial bulging may be seen dependent upon the amount of work required of the heart.

(G) The X-Ray may be of great value especially in the early cases which show no objective signs. By its means we may diagnosis such things as an enlargement of the pulmonary artery in the II. interspace—enlargement of any of the chambers. A skilled observer may note a definite picture of a patent ductus arteriousus.

(H) The Electro-Cardiagrams.

(a) All congenital heart lesions do not have characteristic electro-cardiagrams.

(b) They are not all abnormal.

(c) Many diagnoses by this method have been proven wrong at autopsy.

(I) Other signs:

(a) Sensitivity to cold — lowered temperature.

(b) Petechial haemorrhages—particularly of skin capillaries.

(c) Retardation of growth.

(d) Mental abnormalities — headaches—instability—tics—unnatural habits, etc., may be seen.

A Clinical Classification.

At present a very satisfactory clinical classification divides the cases into non-cyanotic and cyanotic cases, dependent on whether the mechanical disturbance produced by the defects leads to a shunt of blood from arterial to venous or venous to arterial side.

A. The non-cyanotic is made up of three chief forms. 1. Pat. For. ovale. 2. Pat. duct. art. 3. Defect of intervent septum. All are characterized by slight symptoms and marked physical signs. Usually a peculiar harsh murmur of unusual rhythm or intensity often situated in the left upper praecordium associated with evidence of dilatation of the pulmonary artery are the important features of this group. Prognosis for life is good, the danger may occur in infection and overstrain.

B. The principal form of cyanotic type is pulmonary stenosis. The symp-

toms are more important than the signs. These are cyanosis—clubbing of the fingers—dyspnea. Prognosis is not good, but adult life may be reached. Pulmonary tuberculosis and Bact. endocarditis are usually responsible for death.

Differential Diagnosis.

Cyanosis and clubbing of the fingers may also occur in other diseases —the murmurs may be at times absent or not heard on account of hurried respiration or crying.

1. Acquired heart disease—in older children a history of one or more attacks of tonsilitis—rheumatism or chorea. However, in the early stages differentation is very difficult. Acquired cases are rare under 4 years of age, the left side is usually involved first and the murmur is usually apical.

2. Atalectasis cyanosis is usually intermittent, being more prominent around the face and the extremities. Heart sounds may be feeble but no murmurs.

3. Hypertrophy of the thymus—no murmurs—X-ray may clear up diagnosis.

4. Asthma—the nature of the attacks—the wheezing, prolonged expiration and absence of murmurs.

5. Broncho pneumonia — physical and general signs are usually sufficient.

Prognosis.

Generally speaking, the prognosis is quite serious. It depends largely upon the effect of the lesion on the circulation—the amount of cardiac strain or the degree of O_2 unsaturation.

The earlier and more frequent the cyanosis the poorer the prognosis. Persistent cyanosis, continued low temp., marked increase in red cells—dilation of heart—point to a grave condition with rapid fatality.

The most benign lesions are the patent ductus arteriosus. The most severe is pulmonary stenosis.

Many patients die within a few weeks and at least 50 per cent. within the first few years of life. Of those who live to adult life a great many fall prey to pulmonary lesions—especially tuberculosis, frequently bacterial endocarditis ensues.

The causes of death in the 850 cases cited before were:

Failure of heart	185
Sudden death	143
Broncho pneumonia	48
Cerebral disease	40
Bact. endocarditis	39
Other infections	83

Treatment.

It is unsatisfactory and almost entirely symptomatic. Primarily based on two factors, conservation of heart muscle and prevention of infection.

A. Prenatal care—includes guarding of the prospective mother from all sources of infection—shielding her during the critical early months from trauma.

B. Preventative treatment of mild cases. The expectation of life is good as long as the patients remain within their limits of reserve force, and unless endocarditis sets in at the site of the lesion. They should be watched, carefully guarded against overstrain—sources of focal infection should be eradicated and prompt treatment of any colds or other infections.

C. Preventative treatment for severe cases. Breast feeding should be continued as long as possible, should dyphnea make nursing impossible the breast milk should be fed through a bottle.

Uniform temp. should be maintained if necessary by the application of artificial heat. There must be isolation from infection and similar prevention as in mild cases. In the older children a definite amount of mild exercise is valuable; over-exertion should be avoided and the best results should be obtained by gradually increasing the amount of exercise without overstepping the tolerance.

D. Symptomatic treatment.

For the relief of the heart—venesection and leeches may relieve the over-

burdened right heart. Inhalation of O_2 is of no value in these cases.

In these cases where we have convulsions following cyanosis and dyspnea it is of great value to use morphia in the form of tinct Opii camphorati—one drop per month of the infant, or morphine sulphate 1/75-1/50 gr. for a child of one year. Other sedatives may be given as indicated.

Intracranial Haemorrhage of the New Born.

Etiology: It may occur in difficult labours instrumental labours and rarely in normal labours. It may be produced through a fracture, a fissure of the cranial bones or by a rupture of a cerebral or meningeal vessel.

In a difficult labour—it may occur from direct instrumentation or in marked moulding of the head when we have extreme overlapping of the cranial bones with compression of the sinuses.

In normal labours it may occur from no apparent cause—however, the child may have a haemophilic tendency and slight trauma may produce the haemorrhage. Our present work on the haemorrhagic disease of the new-born tends to prove that a large number are due to this cause rather than trauma.

Pathology.

The haemorrhage may be epidural, subdural or subarachnoidal.

The former give use to the internal cephalhaematomata.

Those in the subarachnoidal extend to the convexity of the cerebral hemispheres and from the medial margin diminish in intensity at a lower level.

Among the intracranial haemorrhages of the new-born by far the most important is the subdural. In some cases the blood is derived from the veins opening into the longitudinal sinus. This is caused by compression of the sinus with stretching and tearing of the veins.

A considerable number arise from tear in the tentorium occurring in lateral compression of the head—overstretching of the falx cerebri and tearing of the tentorium. The tear is usually situated in the free edge near its middle part.

Signs and Symptoms.

In a considerable number of cases death occurred a short time after birth—either in an asphyxiated state or after the first few breaths.

Frequently, however, the infant rallies and the symptoms come on gradually. The first change to the increased pressure is a compensatory widening of the sutures plus bulging of the fontanelles. Soon, however, this is exhausted and we have symptoms of cranial compression. They usually come on within 3 or 4 days, usually the 2nd.

The symptoms which are most apparent and characteristic are those disturbances in sensory and motor areas. These are manifested by signs of irritation.

1. Restlessness, crying, refusal of food.

2. Twitching of groups of muscles, general tremours particularly of the lower jaw, convulsions.

3. Local irritation, irregular pupils, nystagmus, strabismus, high-pitched cry.

4. Irregular respiration, slow pulse, increased blood pressure.

5. Tense fontanelles.

6. Cyanosis of lips—often of whole body.

It is usually constant, and probably due to increased aeration of blood in lungs.

7. In severe cases this passes into paralysis, parises, cessation of respiration—death within 5 to 8 days.

8. A diagnostic measure is the lumbar puncture—it may show blood in the spinal fluid. In certain cases we use subdural punctures through the fantanelles.

Differential Diagnosis.

The diagnosis is easy to form when the symptom complex is marked and by a consideration of the history. However, simple cerebral contusions,

hydrocephalus, and meningitis may give somewhat similar symptoms.

The haemorrhage is usually unilateral, producing an asymmetrical swelling of the skull; the sutures on that side gape unduly. However, unilateral hydro cephalus may give a similar picture.

A lumbar puncture may give evidence of blood in the spinal fluid, crenated or broken down cells. Some believe that delayed coagulation time in addition to the bloody spinal fluid makes diagnosis certain. One must not forget that the absence of blood in the spinal fluid also does not preclude the haemorrhage, as haemorrhage in the ant. fossa will often show no sign in the spinal fluid.

One can also make a differential diagnosis between haemorrhage in the hemispheres and the subtentorial type. In the latter type the convulsions and signs of irritation are less, but change in respiration—pulse and blood pressure are more marked.

PROGNOSIS.

It is not absolutely bad—a few cases showing a positive sign may recover. However, prognosis should be made reservedly even when the manifestations disappear within a few days. The danger of permanent effect remain—paralysis—idiocy and epilepsy. Zappert says the haemorrhage is important in the etiology of:

1. General rigidity—little or no dementia—usually no convulsions (Little's Disease).
2. Simple hemiplegia plus mental deficiency and convulsions.
3. Bilateral hemiplegia with mental deficiency and pseudo bulbar paralysis.

TREATMENT.

Treatment is mainly symptomatic.

(a) Feeding necessitates great care. Children who do not swallow well should be fed by a gavage tube, plus fluid per rectum.

(b) With symptoms of great pressure, the attempt to puncture and aspirate should be considered. The same is true for puncture of the fontanelles. If the symptoms point to cortical pressure, trephining should be considered—methods vary in various regions—Cushing, Seitz, Sharpe.

(c) Treatment of the convulsions may be tried by administration of Sod. Bromide and chloral—2 grains per rectum every six hours. Every method of keeping the baby quiet should be tried.

(d) In the case of definite delayed coagulation time a transfusion may be of great value.

(Part II. will follow next month).

Tendon Sheath Infections.

By J. F. CURTIS, 3T0.

A study of tendon sheath infections must include an accompanying study of the fascial spaces.

Its comprehension lies primarily in the knowledge of the anatomy of the parts involved.

ANATOMY.

(A) General.

The muscles of the palm of the hand are grouped into those of:

(1) The thenar eminence.
(2) The little finger which give rise to the hypothenar eminence.
(3) The middle of the palm and between the metacarpal bones.

The thenar eminence consists of the opponens pollicis muscle which lies on and is inserted into the first metacarpal bone. Covering this muscle are the flexor pollicis brevis and abductor pollicis brevis.

The structures on the palmar surface may be grouped into four layers. The

deepest layer consists of the adductor transversus pollicis which lies on the first and second metacarpals. The deep palmar arterial arch also lies here. In the next layer are the tendons of the flexor digitorum profundus and the lubrical muscles. The lumbricals, which are four in number, arise from the Flexor digitorum profundus and are inserted opposite the metacarpo-phalangeal joint into the tendinous expansion of the Extensor Digitorum Communis.

The next layer consists of the tendons of the flexor digitorum sublimis. Over these tendons are found branches of the median nerve and the superficial palmar arch which are covered by the palmar aponeurosis and skin.

The hypothenar eminence is composed of the abductor digiti quinti, the opponens digiti quinti and the Flexor digiti quinti brevis.

(B) Tendons.

An ordinary tendon consists of bundles of white connective tissue fibres. Between the bundles are lymphatics and small arteries and veins. Surrounding the bundles as a whole is a thin layer of mesothelial cells which in reality is the visceral layer as opposed to the parietal layer also made up of mesothelial cells. Between these two layers is a delicate web called the vincula vasculosa and a small amount of fluid which acts as a lubricator. The tendon receives its blood supply both through this web and by vessels which run along the fibres from the palm.

The synovial sheaths which surround the tendons of the index, middle and ring fingers extend from the base of the distal phalanx to a line on the palm drawn from the end of the proximal crease at the index finger to the end of the distal crease at the little finger. Opposite the phalanges the theca is thickened and its fibres are transversely directed, but in front of the joints its fibres are oblique and much thinner to allow flexion.

The synovial sheath of the flexor pollicis longus begins at the base of the distal phalanx. It is closely attached to the proximal, but lies deep to the muscles of the thenar eminence over the first metacarpal bone. The sheath may end about the middle of the metacarpal bone or as is usually the case, continue in a dilated form as the radial bursa. This bursa acts as a sheath for the flexor pollicis longus tendon in the palm. It passes upwards to terminate about an inch above the transverse carpal ligament, ending by a rounded cul de sac deep to the flexor carpi radialis and superficial to the pronator quadratus.

In the little finger the sheath of the flexor tendon is similar to that in the ring finger, but it communicates with the ulnar bursa in about one half of the cases. When the separation is present it varies from a simple narrowing to a complete occlusion some millimeters in length. This bursa is also a synovial sac consisting of a common cavity, to the ulnar side of the tendons, and three compartments extend from it in a radial direction. One reaches in between the tendons and palmar fascia (pretendinous), one between the superficial and deep tendons (intertendinous), and one deep to the deep tendons (retrotendinous). The sac overlaps the metacarpals of the ring and middle fingers and passing up under the transverse carpal ligament, reaches the forearm deep to the flexor tendons.

(4) The lumbrical muscles have no synovial membranes, yet there is a definite fascial sheath through which each passes to its insertion on the radial side of the base of the first phalanx of the second to fifth digits. They are of importance in regard to the fascial spaces of the palm.

(C) Dorsum of the Hand.

There are six synovial sheaths on the dorsum of the hand for the tendons of the extensor muscles of the wrist. These sheaths begin just proximal to the transverse carpal ligament and pass beneath the ligament extending distally on the dorsum for a distance of four or five centimeters.

They are arranged as follows:

(1) Abductor Pollicis longus and Extensor pollicis brevis on the lateral side of the styloid process.
(2) Behind the styloid process for the Extensores Carpi radialis longus and brevis.
(3) About the middle of the dorsal surface of the radius for the Extensor Pollicis longus.
(4) Extensor Digiti Communis and Extensor Indicis Proprius.
(5) Extensor Digiti Quinti Proprius.
(6) Extensor Carpi Ulnaris.

Fascial Spaces.

It is to be remembered that the fascial spaces are merely potential.

1. The Dorsal Subcutaneous Space.

This is an extensive area of loose connective tissue lying between the skin and the tendons. The space is obliterated on the radial side of the index finger and on the ulnar side of the little finger. The space extends entirely around the middle and ring fingers. These spaces merge into each other at the web of the palm and are in close relation to the lumbrical muscles. The space is obliterated slightly proximal to the web in the palm, but is continued on to the dorsum of the hand. These spaces are of importance because pus spreading along the lumbrical muscles will thus point to the dorsum.

2. Dorsal Subaponeurotic Space.

This space lies between the extensor tendons and the subjacent metacarpal bones and interosseous muscles. It is somewhat triangular in shape, with its apex proximally at the wrist and its base distally at the knuckles where it communicates with the subcutaneous tissue of the web.

3. Middle Palmar Space.

This is a large free space with several fibrous septa running through it extending from the middle metacarpal bone to the radial side of the metacarpal bone of the little finger. It is bounded dorsally by a thin fibrous sheet which overlies the anterior interosseous membrane and by the interosseous muscles. Upon its plantar side is a second thin sheet separating it from the flexor tendons and lumbrical muscles of the little and ring fingers. The space is in close relation radially with the thenar space and is overlapped on its ulnar side by the ulnar bursa. It passes distally almost to the heads of the metacarpal bones and ends proximally just under the distal border of the annular ligament.

4. Thenar Space.

This space occupies approximately the area of the thenar eminence. It is bounded in front by the short muscles of the thumb and by the thenar part of the palmar fascia. Dorsally it is bounded mainly by the adductor transversus. It lies entirely to the radial side of the middle metacarpal bone and is bounded on the radial side by the radial bursa.

A diverticulum extends out from the thenar space along the first lumbrical muscle and occasionally along the second lumbrical. Proximally the thenar space extends almost to the transverse carpal ligament while distally it reaches nearly to the proximal transverse palmar crease.

5. Hypothenar Space.

This space occupies the hypothenar eminence. It is a definitely localized space and while pus may accumulate here, it would spread only to the surface.

6. Lumbrical Canals.

These fascial spaces are not well defined. They are in close relation proximally to the middle palmar and thenar spaces and distally to the connective tissue on the dorsum of the hand.

PATHOLOGY.

(A) Etiology.

(1) Direct Extension.

As a result of deep lacerating wounds extending deeply as far as the tendon sheaths infection may ensue.

(2) Lymphatic.

Following a slight wound on the palmar surface the sheaths may become infected by lymphatic extension. This mode of infection is most commonly met with in the distal and middle phalanges and is almost always of streptococcal origin.

The reason this type of infection does not occur from wounds on the dorsum is because the course of the lymphatics is from the palmar to the dorsal surface.

(3) Haematogenous.

Gonococcus tenosynovitis is rare and is of haematogenous origin.

(B) Extension of Infection.

(1) Infection originating in the tendon sheath of the index finger may spread by:

(a) fascial extension.
(b) lymphatic extension.
(c) synovial sheath extension.

(a) Fascial Sheath Extension.

As a result of the loose connective tissue around the phalanx infection usually spreads to the dorsum of the hand. Not infrequently the pus extends internally to lie in the cellular tissue at the web between the index and middle fingers and from thence spreading by way of the lumbrical canals to the middle palmar space. Extension from the middle palmar space to the thenar space is possible, but not probable. However, a metacarpophalangeal arthritis may develop secondarily with destruction of the bone and ligaments.

(b) Lymphatic Extension.

Secondary to tendon sheath infections it is common to find a subcutaneous accumulation of pus of lymphatic origin on the flexor surface of the wrist.

(c) Synovial Sheath Extension.

Rupture of the proximal end of the tendon sheath would result in the invasion of the pus into the loose connective tissue surrounding the tendon. Persistance of the infection would result in the spread of the pus along the lumbrical muscles breaking finally into thenar space.

(2) Infection originating in the tendon of the thumb may spread by:

(a) Extension along the tendon sheath into the radial bursa.
(b) Rupture of the tendon sheath in its course resulting in the pus coming to the surface.
(c) Rupture of the sheath in its distal part resulting in the spread of the pus into the connective tissue space along the ulnar side of the thumb and thence into the thenar space.

(3) Spread of infection of the tendon sheath of the middle finger is usually caused by rupture of the synovial sheath at its proximal end resulting in the spread of infection to the middle palmar space. Rarely infection may spread from the middle palmar space to the thenar space and vice versa.

A deep-seated accumulation of pus on the dorsum of the hand would spread in the subcutaneous tissues around the finger to the palmar surface extending along the lumbrical muscles into the middle palmar space.

(4) Infection originating in the tendon sheath of the ring finger may spread by way of the fascial canals of the lumbrical muscles to reach the middle palmar space. The thenar space may also be invaded, but it is not usual for this to occur.

Suppurative arthritis of the metacarpophalangeal joint, osteomyelitis of the diaphysis of the third and fourth metacarpal bones, or sub aponeurotic infection on the dorsum could also infect the middle palmar space.

(5) Infection originating in the tendon sheath of the little finger may spread by:

(a) Extension of the pus into the ulnar bursa with rupture into the forearm. This is the result in fifty per cent. of cases. Where there is no connection with the ulnar bursa rupture of the sheath would result in the

spread of pus into the middle palmar space.

(b) Extension of the infection by way of the fascial spaces of the lumbrical canals to the middle palmar space.

It is to be remembered that in all the fingers pus may point to the surface through the palmar fascia.

(6) Extension of the Palmar Infections.

Infections of the palm itself are either supra or subfascial.

Supra fascial infection is relatively unimportant, as simple incision is all that is required.

However, in the distal part of the palm there are deficiencies in the palmar fascia between its prolongations so that pus may pass deeply between them and collect on the dorsum of the hand. This is the so-called distal palmar hourglass abscess.

(7) Extension of infection from the ulnar bursa may result in:

(a) Rupture into the Space of Parona. This is a cellular tissue space situated in the wrist between the deep flexors in their synovial sheaths anteriorly and the pronator quadratus posteriorly. The pus then spreads to lie more superficially beneath the superficial flexors in relation to the ulnar vessels and nerve.

(b) Extension from the ulnar bursa to the radial bursa. There is a direct communication between the two bursae in fifty per cent. of cases.

(c) Extension to the middle palmar space either directly or by lymphatic spread.

(d) Extension to the thenar space. This is a rare occurrence, but may do so in one of three ways.

(i.) By direct or lymphatic extension.

(ii.) By spread of infection to the middle palmar space then to the thenar space.

(iii.) By involvement of the radial bursa and thence the thenar space.

(8) Infection of the radial bursa. As in the case of the ulnar bursa, infection may spread into the forearm. The course of subsequent events is very similar.

(9) Infection of the middle palmar space rarely causes involvement of the ulnar bursa.

Extension to the thenar space is unusual, but may occur by direct spread through the weak or deficient proximal part of the fibrous septum between the two cellular spaces.

(10) In the thenar space infection.

Pus may spread to the dorsum of the first interosseous space.

Involvement of the radial bursa is uncommon.

DIAGNOSIS.

There are certain facts to be remembered.

First, that the greatest swelling does not indicate the location of the pus. The greatest amount of swelling occurs where there is loose connective tissue, that is, upon the dorsum of the hand.

Secondly, the site of the greatest tenderness is of marked importance in the location of pus.

Thirdly, although lymphangitis, tenosynovitis, and fascial space infections are usually distinct processes, yet all three types may be combined.

The diagnosis of acute suppurative tenosynovitis is based on the following points:

(A) General.

(1) There may or may not be a history of injury.

(2) The systemic symptoms of infection are usually present, headache, chills, fever, rapid pulse, restlessness, anorexia, leucocytosis, etc.

(B) Local.

The three cardinal symptoms and signs of tendon sheath infection are:

(1) Exquisite tenderness on pressure over the course of the sheath and particularly at three points:
   (a) Front of the middle phalanx.
   (b) Front of the proximal phalanx.
   (c) Over the head of the metacarpal bone.
(2) Flexion of the finger involved.
(3) Excruciating pain on extending the finger, being most marked at the proximal end.

The following accompanying symptoms are also significant:

(1) The finger involved is symmetrically swollen.
(2) The dorsum of the hand is oedematous.
(3) The fingers are all slightly flexed.
(4) The whole hand is slightly tender to superficial palpation.

The question of Fascial Sheath Infection should be first investigated from the standpoint of extension from other foci.

The diagnosis of Middle Palmar Space infection is based on the following points:

(1) A loss of concavity in the palm and a slight bulging in spite of the palmar fascia.
(2) Tenderness to pressure is exquisite and early is limited to outlines of the space.
(3) Extension along the lumbrical canals takes place in the web between the fingers and with this there is a flexion of the fingers.
(4) A swelling of the thenar space of almost the same degree as that of the middle palmar space, but this is due to oedema.

Infection of the thenar space is evidenced:

(1) By a ballooning out of the thenar eminence which is characteristic of this type of infection.
(2) By a slight flexion and a marked abduction of the thumb.

Involvement of the hypothenar space may be diagnosed by:

(1) The relative lack of swelling in the palm.
(2) Absence of involvement of the tendons.

DIFFERENTIAL DIAGNOSIS.

(A) Cellulitis.

(1) The tenderness is not confined to the tendon sheath.

(2) As there is no tendon sheath on the distal phalanx of any of the digits, tenderness here would rule out tenosynovitis unless extension had taken place from the latter.

(3) The tenderness is not as exquisite as in tendon sheath infection.

(4) The swelling spreads very rapidly to the dorsum of the hand.

(5) The patient does not show as severe a systemic reaction as he does in tenosynovitis.

(B) Acute Suppurative Arthritis.

(1) There is tenderness only over the joints.
(2) The tenderness on pressure instead of being antero-posterior as in tendon sheath, is latero-medial.

(C) Osteo-myelitis.

Osteo-myelitis of the metacarpal bones is present in the diaphysis and pain is maximum over the dorsum of the affected bones.

(D) Lymphangitis.

The differential signs are:

(1) Lack of extreme tenderness along the tendon sheath.
(2) Only a slight pain on extending the finger.
(3) Rapid increase of swelling of whole hand and dorsum with great redness.
(4) Red lines of lymphatic infection running up the arm.

TREATMENT.

A. Where diagnosis is in doubt hot boracic compresses should be applied.

B. When diagnosis is made incision is the rule. Early diagnosis is essential both to the present status of the patient and to the prognosis of the case.

The patient should be given a general anaesthetic and the incision made in a field rendered bloodless by the application of a broad tourniquet to the upper arm.

Index, Middle and Ring Tendon Sheath Infections.

Two incisions usually are sufficient, one on the antero-lateral side of the middle phalanx, the other on the opposite side of the proximal phalanx and extending into the palm for about half an inch.

Little Finger Tendon Sheath Infection.

The incision instead of stopping half an inch above the web of the finger, should be continued up the palm as far as the lower border of the annular ligament. If pus spreads above this ligament it will come to lie between the pronator quadratus and the deep flexor tendons. If such is the case, an incision is made from a point on the ulnar side of the forearm, on a level with the flexor surface of the bone, about two inches above the styloid process and extending three or four inches proximally. The finger is introduced into this incision and the ulnar bursa ruptured. If the radial bursa has also become infected a probe is inserted into the incision and directed along the flexor surface of the bones. It is then cut down from the radial side and a drain inserted.

Tendon Sheath Infection of the Thumb.

The incision is made along the ulnar side. It is not carried up farther than half an inch distal to the lower border of the annular ligament so as to preserve the branches of the median nerve which pass superficial to the ligament.

If either osteomyelitis or arthritis of a finger is associated with tenosynovitis then amputation is the rule. The only exception is in the thumb, as any kind of a thumb is better than none at all.

Middle Palmar Space Infection.

First of all the preceding condition, if present, is treated. The space is drained by an incision in the palm extending from the web between the middle and ring fingers for one and a half inches proximally. A blunt sinus forceps is then introduced along the deep surface of the lumbrical muscles into the space. A rubber drain is left.

The thenar space is drained by making an incision along the radial side of the index metacarpal parallel to the web between the thumb and index finger. A blunt sinus forceps is then introduced between the adductor transversus muscle posteriorly and the short muscles of the thumb anteriorly. Care must be taken to avoid penetrating the middle palmar space. A rubber glove drain is left.

Post Operative Treatment.

Rubber glove drains are inserted into all the incisions but not extending into the tendon sheath itself. Moist dressings are applied. The day following the operation the hand affected is put in hot saline solution for half an hour every three or four hours. This is kept up for three or four days, moist dressings being applied in the intervals between baths.

Dry dressings should be used as soon as possible and dry heat applied. Prolongation of the saline bath treatment leads to waterlogging of the tissues. Movement should be started in about ten days and gradually increased in amount.

Infection of the tendon on the dorsum of the hand is rare and diagnosis is fairly easy. Incisions in the line of the tendons is the most satisfactory method of treatment.

PROGNOSIS.

The chances of complete restoration of movement are very slight indeed for a tendon sheath infection. However, where early diagnosis and incision are made the chances are much increased.

The Mechanism of the Flow of the Bile.

By T. R. SARJEANT, B.A., 3T1.

The physiology of the gall-bladder and the so-called resistance of the sphincter of Oddi have attracted considerable attention, especially from a surgical point of view. Because of the pathology so frequently found in the gall-bladder and its ducts, an understanding of the mechanism is essential to the physician.

Many investigators have studied the anatomy of the biliary tract. Oddi, in 1887, found in the dog near the mouth of the bile-duct, a muscular ring which, after separation from the intestinal musculature could be considered as an independent sphincter. Others, such as Hendrickson, Mann, Auster and Crohn, found either no semblance of a sphincter whatever, or merely a few muscle fibres encircling the end of the duct, but which were continuous with the intestinal musculature.

Measurements of the resistance to the passage of fluids from the bile-duct into the lumen of the intestine have been made by numerous workers, and Burget's results with dogs vary from 50-210 mms. of Hg. This great variation of results suggested to Burget, of the Medical School, University of Oregon, that some other factors must be influencing the biliary flow, for the anatomical structure of the sphincter of Oddi did not seem to be equal to such physiological importance as these results would indicate.

In most animals, including man, the duct passes through the wall of the intestine in a very oblique manner. In the dog the duct lies in the intestinal wall for about 1 to 1½ inches before making its entrance into the lumen of the intestine. Burget points out that as a physical arrangement this would act as an efficient sphincter, depending on the tonicity of the intestine. This portion of the duct is subject to collapse and would offer a resistance to the flow proportional to the state of tonicity of the intestinal musculature.

He used dogs under ether anesthesia for all experiments. A cannula was placed in the duct a short distance from the intestine and connected to a manometer and pressure bottle containing water. In a series of twenty dogs the pressure withstood or held by the duct varied from 2-12 mm. of Hg. according to the condition of the animal and the degree of anesthesia.

Burget increased the tonicity of the intestine before the experiments by an injection of eserin. Adrenalin caused temporary relaxation of the intestiue and the duct pressure fell almost to zero. Atropine had a similar effect.

Pilocarpine and eserin both brought about considerable increase in the pressure withstood in the duct. Mechanical stimulation of the duodenum increased its tonus and likewise the amount of pressure that may be held in the duct.

Still another interesting experiment was performed which tended to eliminate the possibility of sphincter action. Cotton twisted about a wire and saturated with 4% cocaine solution, was inserted into the duct and the end passed into the lumen of the intestine so that the sphincter, if present, would also be cocainized. The pressure in the duct was then 8 mm. of Hg. Eserin (5 mgm.) was injected intravenously and the resistance was increased to about 24 mm. of Hg.

Mann stated that the acid chyme from the stomach produced a relaxation of the sphincter of Oddi. Bourget investigated this by introducing a 0.4 % solution of HCl. into the duodenum above the opening of the duct. It had a similar effect to that of the acid chyme. A series of peristaltic waves were set up in the duodenum which

reduced the pressure in the duct by a milking action.

The fact that strong inhibition of the intestine brought about by adrenalin and that brought about by paralysis of the parasympathetic by atropin result equally well in lowering the resistance in the duct, would indicate that if there is a reciprocal activity between the gall-bladder and the sphincter such a mechanism does not play a very important role in regulation of the bile-flow.

Judd and Mann found that cholecystectomy produced a dilation of the ducts. The dilation did not occur, however, if the duct was dissected free from the muscle fibres of the duodenal wall. This tends to prove that the seat of resistance is certainly in that portion of the duct in the intestinal wall.

A great tonicity is not required to close the lumen of the duct; the normal tonus of the duodenum is no doubt sufficient to stop the flow when the gall-bladder is present. Inspiration, which increases the intra-abdominal pressure, has been observed by Rost to cause the bile to spurt into the intestine.

The foregoing evidence seems to emphasize the fact that the tonicity of the intestine and the duodenal peristalsis are the main factors in the regulation of the biliary flow. Burget does not consider this absolutely proven, however, but he is not satisfied with any demonstrations to date of the reciprocal action between the gall-bladder and sphincter. He favors the hypothesis, therefore, that the mechanism of the bile-flow is regulated by intra-abdominal pressure, tonicity and peristalsis of the duodenum, rather than any such reciprocal activity.

To carry this point further, Burget attempted, and succeeded, in eliminating the so-called sphincter of Oddi. It is obvious that in so doing he ought to interrupt the reciprocal activity if it is present, between the sphincter and the gall-bladder.

His method was to dissect through the duodenal wall down to the bile-duct at a point just back of the papilla of Vater, with as little injury as possible to the tissues. The duct was sectioned and a hole made in the mucosa and the proximal end of the duct turned into it. The wound was easily closed and the dog given 6 to 8 weeks for recovery. By this method the sphincter was excluded, yet the duct was undisturbed throughout the greater part of its intra-mural portion.

By the usual mode of testing, the resistance in the duct was found to be an average normal resistance. The resistance varied as in the normal dog—increasing with the injection of eserin, and decreasing with decrease in tonicity of the intestine caused by adrenalin or atropin.

This evidence seems to exclude all probability of there being a reciprocal activity between the sphincter of Oddi and the gall-bladder.

As for contractions of the sphincter itself, Whitaker and Boyden thought they had discovered rhythmic contractions of this supposed mechanism. After giving an egg yolk and cream meal the emptying of the gall-bladder took place periodically. They believed this to be due to rhythmic contractions of the sphincter and peristaltic waves over the ducts.

Burget showed, however, that the injection of pituitrin revived this rhythm after it had disappeared. Robins and Boyd have shown that fats depress the tonicity of the gastro-intestinal tract. This latter fact then would account for the flow of bile, and the activity of the intestine under the influence of the pituitrin would cause the rhythmic action.

So we see that the sphincter of Oddi is probably not at all concerned in the regulation of the flow of the bile, at least in those animals where the duct enters the musculature obliquely, for drugs that affect the tonus of the intestine affect the resistance found in the duct to the same extent in the absence of the sphincter as when it is intact. This oblique entrance of the duct and the tonicity of the duodenal musculature act as a sphincter-like mech-

anism that prevents the continuous flow of bile in the presence of a gall-bladder.

Burget's hypothesis is therefore further strengthened regarding the regulation of biliary flow by intra-abdominal pressure, tonicity and peristalsis of the duodenum. Kodama, working in Graham's laboratory in 1926, also made a statement much the same as this. He believed the biliary flow to be regulated by the mechanism of closure of the ampullary end of the duct which was directly dependent on the tonicity of the duodenum. In his opinion, the elasticity of the gall-bladder wall and the intra-abdominal pressure were the two main auxiliary factors.

There is one thing left to consider and that is the role of the gall-bladder in biliary regulation. The primary function of the gall-bladder is to transform a continuous glandular secretion into a discontinuous elimination. The advantage of this mechanism is obvious, for it causes the storage and concentration of the bile until such time as it is required, that is, until food passes into the duodenum. The filling of the gall-bladder is undoubtedly made possible by the resistance caused by the tonicity of the duodenum. The actual filling, of course, is due to secretion of bile in the liver. The secretory pressure of the liver will bring about distention of the filled gall-bladder, and due to the elasticity of its walls, a pressure will be exerted on its contents.

Many have claimed that there is an active forceful contraction of the gall-bladder when bile is required in the intestine. Histological examination of the ducts and of the gall-bladder shows a very few smooth muscle fibres scattered amongst a large quantity of connective tissue. There does not seem to be sufficient muscular tissue present to produce the contractile power claimed for the bladder.

The fur has flown rather thickly over this question, but the conclusion which Burget has arrived at is in the negative. He inserted a small balloon in the gall-bladder and inflated it to a pressure of 12 mm. of water. Intestinal tonus and blood pressure were also recorded. Rhythmetical tonus changes at the rate of two or three per minute were observed in the gall-bladder. This coincides with the rate found by Dr. N. B. Taylor and Dr. M. J. Wilson, working on the same problem. No relationship could be observed between these changes and peristalsis of the duodenum. Drugs which affected the intestine had no effect on the tonus rhythm of the bladder. Barium chloride (5 mgm.), however, injected intravenously caused definite augmentation of the bladder rhythm.

The effect of a fat meal was also investigated. One hour and 45 minutes after a meal of egg yolks and olive oil, the pressure had risen to 140 mm. Tonus rhythm had then disappeared almost entirely. The pressure decreased during the next five hours to 90 mm. and the tonus rhythm had reappeared. It appears then that tonus changes of the gall-bladder can scarcely be of major importance since they disappear when most needed, that is, when the bile is under the greatest pressure. Therefore, we conclude that the rise in pressure was due to secretion of bile and that, when this pressure overcame the resistance at the intestine, bile began to flow.

Wakerlin, in 1926, placed an aseptic balloon in the gall-bladder of a dog and after a few days he connected the balloon to a manometer and found tonus changes to be present but he could not produce further contractions by any method whatsoever. This is a fairly conclusive piece of work, for the gall-bladder was practically in a normal physiological state evidenced by the fact that normal tonus changes were obtained, and in addition to this the dog was not in anesthesia.

Other experimenters such as Winklestein and Aschner, Auster and Crohn, were also unable to produce contractions which would suggest that the organ was capable of expelling bile.

All this work was done under light anesthesia or without anesthetic at all, and therefore, as I mentioned before,

the organ was in a practically normal physiological condition. If it would not respond, under these conditions, to the ordinary means of stimulating smooth muscle, a conclusion that it is incapable is justified.

In clinical practice a 25 per cent solution of Magnesium Sulphate introduced into the duodenum by a duodenal tube is used to bring about a flow of bile, thus draining the gall-bladder. It is commonly believed that this salt causes a relaxation of the sphincter of Oddi. In 1914, Meltzer showed that Magnesium Sulphate, introduced in this manner, definitely depressed and inhibited the duodenal musculature producing marked relaxation. The foregoing discussion rather conclusively rules out the existence of a discrete sphincter of the bile duct, and therefore, the salt's pharmocological action in producing a bile drainage must be merely one of relaxing the duodenal musculature.

Following injury to the gall-bladder, oedema may develop. In this condition, the tonus rhythm ceases, and a gradually increasing pressure is exerted on the contents which resembles a slowly developing contracture and might easily be mistaken for such.

Conclusions:

Hence, we see that the chief factor in the emptying of the gall-bladder is the elasticity of its wall which, when under tension, aids the flow of bile in a passive manner.

The theory of a reciprocal activity between the gall-bladder and sphincter of Oddi bringing about expulsion of bile seems to have no experimental basis.

Finally, the evidence that the gall-bladder plays only a passive role in bile flow further confirms Burget's conclusion that the process is regulated by tonicity and peristalsis of the duodenum, with elasticity of the gall-bladder and intra-abdominal pressure as auxiliary factors.

Medical Progress in An Economic World.*

By RAY LYMAN WILBUR, M.D.,
President, Stanford University.
Former President, American Medical Association.

The saddle bag age of medicine has passed, but "saddle bag" thinking on the part of the profession and the public is still with us. Medicine has become an applied science in which the art of medicine must rest upon a fact basis or become a comparative failure.

We live in an economic age, but medicine as an organized profession does not fully realize it. With billions of dollars involved in the care of the sick, the employment of economic advisers by the medical profession is almost unknown. A modern business has its statisticians and its economists surveying the past and present and preparing for the future. Medicine stumbles ahead as a great social factor led by a few far-seeing individuals, prodded by a lot of uplifters, legislators, and enthusiasts, and with a well-developed defense complex against those changes which come to all growing things. The practice of medicine can only be fully understood by those who have lived it, and yet, unless the profession bestirs itself, great changes in medicine will take place through the instigation and pressure of outsiders. The golden thread of human understanding and of close per-

*A communication from the Committee on the Cost of Medical Care. It is an address given before the 1928 annual meeting of the California State Medical Association and printed in "California and Western Medicine," July, 1928.

sonal relations between doctor and patient may be left out of the new social fabric which is being woven right under our eyes.

Facts Facing the Profession.

We must face the facts, we must study them to see what they mean, we must guide ourselves by what they tell us, not by traditions and thinking that belong on the retired list. The age of gasoline and concrete, of X-rays, modern hospitals, industrial accident compensations, industrial and institutional organization for medical care, group practice and modern public health compel new ideas, and, as Christopher Morley said in his "Thoughts of a Middle-Aged Mandarin,"

> "Breaking in a new idea
> Is like breaking in a new pipe;
> Uncomfortable work.
> I like the old familiar thoughts,
> No bite or parch."

Even if they do bite and parch, leadership requires that ideas be studied and understood. The air is full of legislative and other penances for the one outstanding social and economic fact, i.e., we have not devised a financial system by which all members of society, regardless of economic status, may receive a full or even a reasonable share of the benefits possible through the practical application of modern scientific medicine. Our distribution is faulty because our methods are behind the times and the public thinking is addled. What other business does free work as a part of its regular program? What other business has a sliding scale of charges varying from $25 to $10,000 for the same service? Who knows how much it costs a physician to make a call? We know what cost accounting has done for modern business. Who knows anything about cost accounting in medical practice? We have not even the evidence upon which to develop a modern plan and yet a considerable proportion of the profession are fundamentalists with locked minds when any new procedure is proposed. We cannot escape change. The question is, are we going to guide it ? Many proposals made are not "socialistic" or "bolshevistic." They cannot be quieted by slogans or personal attacks on the experimenters. How can we keep that independence which is essential in the life of the physician and also that close personal relationship between doctor and patient which is vital to successful care of a large proportion of human ailments? Some plan must be devised so that official snoopers will not be projected in between doctor and patient. The physician must show that acute and yet conservative responsiveness that is the basis of the rapid progress of medicine as a science in the development of the practice of medicine in an economic world with new concepts of government, social organization, publicity, education and science.

A Proposed Five-Year Study Program.

Recently some of us have started out on a five-year study program on the cost of medical care. There is already a study going forward on the cost of medical education and of nursing education. The American Medical Association is doing great work in its medical school and hospital studies, and other organizations are making researches and experiments in the field of social medicine. In the work of the Committee on the Cost of Medical Care we have no solutions. Frankly we do not know what should be done. We want to build up the facts with the guidance of thoughtful physicians and social workers and economists and try to see whether new trails can be roughly blazed, along which progress can be begun. If they prove to be well placed they can be broadened and paved for mass advances. We need experimentation and much of it. We should take advantage of the fortunate situation in the United States where we can try things out in individual communities or cities or states and copy them if they prove to be good.

Co-operation of Profession Needed.

Above all, our hope is that we can enlist the thinking of the medical profession. Perhaps the results of the studies will be irritating, they may set up some local inflammation at times, but it is better to build up immunity by small doses than to be overwhelmed. As I view it, medicine as a profession has proven itself too valuable for society to allow it to be inadequate and uneven in its service. Public health has taught us that one man's health is everybody's business.

The 140,000 physicians in the United States, together with the nurses, dentists and sanitarians, have more immediately at stake in proper organization than any other portion of the population. There are great inadequacies in the situation at the present time. It has been stated that in this most prosperous period most of the tonsillectomies done in great cities are done without charge to the patient. Some 15 per cent of the 2,400,000 births each year are not attended by physicians. Uncollectable bills and free work form a very large item in the accounts of the ordinary physician. There have been very large contributions and endowments for medical service, but very few of these take the form of payment for services rendered by physicians. A considerable proportion, too, of the hospitals are not operated for profit. One of the fundamental questions is whether they should be. It is quite clear, too, that the large proportion of our population made up of people of moderate means, who desire to meet all of their obligations, find it difficult, if not impossible, to carry their families through periods of illness. Since our legislative group comes largely from this portion of the population, a sympathetic ear is given to solutions often proposed by those who see only one side of the picture.

There is a gradual encroachment in various directions in the field of medical practice which takes the form of group practice, public clinics, pay clinics, organization of hospital and medical services by great corporations, such as the railroads and industries, student health services in the universities, benevolent societies with hospital privileges; and public health is constantly extending its range. There is no common program, no statesmanship, no strategy, simply the field is gradually being occupied with much overlapping and much dissatisfaction.

Major Aims of the Committee.

The aim of the Committee on the Cost of Medical Care is to try to develop a program which will be based on the three following groups of studies:

1. Preliminary survey of data showing incidence of disease and disabilities requiring medical service and of the existing facilities for dealing with them.
2. Studies on the cost to the family of medical services and the return accruing to the physician and other agents furnishing such service.
3. Analysis of specially organized facilities for medical care now serving particular groups of the population.

There is considerable material available on all these points, but it has not been properly digested and co-ordinated. The following subjects have been given a priority:

1. The diseases and conditions most responsible for disability and inefficiency.
2. Existing facilities for the treatment and prevention of disease and defectiveness—statistical study.
3. Surveys of the medical services of a large city, of a small city, of a rural community.
4. The cost of sickness, during a twelve months' period, among various representative population groups, including the incidence of sickness.
5. Capital investment and income in private practice.
6. Capital investment in hospitals and clinics.
7. Organized medical service in industry and in universities.
8. Pay clinics and group clinics.

"Similia Similibus Curenter."

By C. H. GUNDRY, 3T0.

If some majestic overlord might view our worldling lives, combined in multitudes, as the units in the composition of an opus, he might conceive the sum of all as a splendid symphony. Of this the movements so far completed, according to the thinking of Sir James Frazer, would have three themes —magic, religion, science—following one another chronologically in the order named. For as men's ideas in all times and countries have borne characteristics peculiar to their day and tribal allegiance, so too have there been splendid conceptions which have coloured the thoughts of all the world for long, long ages. Conceptions which arising in the inspired moments of a few daring leaders, have overwhelmed with their audacity the thinking of all men for long years of time and then have died away—always slowly, lingeringly.

In following our medical studies the apparent reasonableness of the idea of evolution in organic development has been impressed on us until it is inherent in all our thinking.

From a similar point of view Sir James Frazer has regarded the advance of philosophy. The earliest of his supreme motifs in this development was Magic; this, he believes, guided the enlargement of man's earliest ideas as to the control of the universe. He has collected a mass of evidence from the customs and folk lore of primitive peoples which has led him to his conclusions, and has presented an abstract of his studies in a most stimulating and instructive book—The Golden Bough.

The people who answered the queries of their adolescence in ways compatable with the oldest theme—magic—had a limited horizon, but within their confined sphere they must have dwelt in glorious independence and self sufficiency. They, as yet, had no need of deities, for by magic they considered that they controlled the forces of the universe. They recognized the factor of change which modified their individual exertions, but thought to control it by means of their instrument Magic.

Two laws, with which the practices of magic are consistant, have been enunciated. (1) The law of similarity —that is like produces like. From this hypothesis the magician infers that a desired action can be brought about by imitation of it. (2) The law of contagion—which postulates that actions performed on an object will influence a person with whom the object was once in contact, after the separation of the person and the object. These two hypotheses are the basis of sympathetic—or homeopathic—magic. Things influence each other at a distance, through sympathy. This mechanism has long survived the old orthodox magic with which it grew and flourished and there are many applications of it to be seen to-day. It was of the resistance of the idea of sympathy, in this sense, to natural decay that I wished to speak, primarily.

In the May Day celebrations, which we rarely see in this country, but which are still, I think, religiously performed in the older lands, there is instanced one of the interesting altered vestiges of the ancient rites of the magicians. Originally, apparently, the idea was to make a bid for abundance of crops and increase of progeny through the medium of trees. Trees and forests as a whole represent the idea of sure fruitfulness and continual virility and the bringing of a tree into the village or some boughs into the habitation would lend to the people and their crops some of those virtues, in accordance with the sympathy principle. This is one of many examples traced in changing form from the earnest rituals of ancient

tribes to the time-honoured but superficially, rather meaningless customs of present-day people.

The practices of magic based on the principles of magic are found among the customs of primitive people all over the world in these modern days, and by studying folk-lore and survivals of antique ceremonies among more advanced races students of the subject have come to the conclusion that all people have passed through a stage when the laws of magic embodied their highest generalizations. Among the customs of natives in Africa, Australia, the Americas, and all parts of the world where man can still be studied in a social state, whose parallel in the case of civilized people antedates history, many examples can be found. Most amazing and instructive is the way the customs of people who are separated by tremendous geographical barriers lend themselves to explanation along the lines of this one idea of belief in sympathetic influence. For instance there are similar tricks of procedure in hunting by which in one way or another the capture or slaughter of game is rehearsed by the hunter before he sets out on the chase. So he will isolate himself for a short time from the society of his women folk lest their feminine insufficiency in matters of hunting communicate itself to him, or he will in some cases sleep with a stick across his neck, simulating the case of an animal caught in a share. There is also the negative side of the question—for as imitation of the capture of an animal may cause fortune to smile on him, so may actions corresponding to eventualities which might keep his prey from his hand, influence an unfavourable outcome; thus elaborate systems of taboo originated probably.

Likewise in matters of healing there are numerous examples of treatment whose rationale was based on the laws of Homeopathic magic. To cite from the Golden Bough: It was believed that the stone curlew if brought into the presence of a patient with jaundice, would cause a cure by the sympathy which existed between the brilliant yellow eye of the bird and the pigment in the skin of the sufferer. There are many such examples in this most fascinating book and one can be assured of the utmost pleasure in the reading of it. At a later stage in human philosophy after the intervention of gods between man and nature, it is reasonable to suppose that the idea of temple sleep owes its origin to the same root; sympathy-patients exposed to the benificent influence of the arena of the gods of healing.

Many tribes, with some premonition of Darwin's ideas, traced their descent back to some species of animal, and probably when they began to be skeptical as to the effectiveness of their magic and considered that tribal gods were needed, their animal ancestor was the obvious one. Thus Totems came into being.

The species which was the Totem of a tribe was sacred and killed only on ceremonial occasions when one was eaten, that its virtues might be given to members of the tribe. When men's ideas began to have a rather more religious trend their tribal animal favourites were worshipped and sometimes human sacrifices offered to them. Possibly the original animal products which were medicinally used owed their popularity to rationale in keeping with ideas of homeopathic magic. Tissues and excretions of animals were commonly used in treatment of disease. The hide of a bull wrapped about a paralysed leg was considered good therapeutics in Scotland not long ago, and we read of Roman and Parisian ladies bathing in milk. Probably, too, the use of herbs in many cases developed from magical rather than empirical basis; mistletoe, for instance, was a sacred plant and was used by northern people as an amulet to ward off disease.

The primitive medicine man was not content to press into service on the excuse of sympathy all sorts of animal,

vegetable and mineral substances, but must make use also of the movements of heavenly bodies. Specially did the waxing and waning of the moon appeal to him as significant, and prognosis frequently depended on the phase of the moon during which symptoms first appeared. Physiological and pathological processes which exhibited periodicity such as menstruation, were related to lunar phases. Epilepsy was considered in the same category and not only the aetiology, but the treatment, was referred to the moon because silver belonged to the sphere of that planet and therefore it was logically used in the treatment of epilepsy.

Some customs obviously founded on belief in the principle of sympathy have been prevalent until quite recently in England and Scotland. It was considered imprudent to leave any clippings of hair or parings of nails where they could be appropriated by any person who might have unfriendly intentions for these excised epidermal appendages were in sympathy with the body whence they came and by performing a little magic on them an ill wisher might bring dire misfortune to the original owner. Thomas Hardy in his book, The Return of the Native, has one of his characters model a wax figure to represent a woman on whom a devastating spell is laid by repeating the Lord's prayer backwards three times while the model is slowly melted. There is another example in the same book when an aged heath-dweller suggests that the only treatment efficacious against the bite of an adder is to rub the wound with the adder's fat.

Erudite housebreakers have availed themselves of the virtues of sympathy frequently, and in accordance with a similar pattern in various countries. Parts of human cadavers were used to lull the members of a house to a deep sleep before an entrance was attempted. The idea clearly being that the bones or other parts, of one sleeping the sleep of death would influence living people to fall into a similar deep sleep.

"Sleep all who sleep—wake all who wake,
But be as dead, for the dead man's sake!"

Many people at the present day find a very diverting form of entertainment in various fortune telling rituals which if they were taken seriously would all imply a belief in a sympathy existing between human destiny and various quite extraneous processes. There is another modern instance where the principles of sympathy have inspired a school for the treatment of disease.

Homeopathy was based on the law "Similia similibus curentur" and was originated by S. C. F. Hahnemann of Mussen, who lived in 1755-1843. The essential features of his theory are that the cure of disease is affected by drugs which are capable of producing in a healthy person symptoms similar to those of the disease to be treated and that to ascertain the curative powers of any drug it must be tried on healthy individuals. Hahnemann also developed a theory that all chronic diseases were derived either directly or indirectly from the itch—from syphilis or from psycosis. This untenable hypothesis, however, was adopted by only a few of even the most enthusiastic followers of the system. The popular idea homeopathy is that it is a system of therapeutics which contends that small doses of drugs only should be used in treatment. This practice, however, is merely a corollary to the law of cure. Hahnemann's therapeutics was derived from his philosophical conception that disease was caused by a spiritual influence and that the actions of medicines of similar spiritual quality cured disease. He also believed that medicines attained their greatest potency from "spiritual dynamization" which was increased by dilution carried out to an extreme degree. His dilutions were increased in geometric progression by tens or hundreds. At present most homeopathists who are practising belong to a "National School" who still hold their law of cure, but supplement

their treatment when their materia medica is incomplete.

So through the years the magician has had a splendid share in shaping men's ways; and whatever the guise he wore, physician, priest or king, the word that has opened men's hearts has been sympathy.

Breach of Contracts With Interne Hospitals.

The attention of deans of medical schools is urgently called to the too frequent instances among recent graduates where contracts made with hospitals in which internships have been accepted, are broken, sometimes without notice and sometimes causing serious embarrassment to the institutions concerned. Evidence of such breaches of contract are hereafter to be filed against the individual graduates concerned and will naturally reflect seriously against their personal character unless statements are furnished to the Council showing that such action was justified. Will you kindly have some notice of this sort placed on your bulletin board where the attention of the graduating classes may be called to it.

*Forwarded to us by Dr. N. P. Colwell, Secretary, Council on Medical Education and Hospitals of the American Medical Association, Chicago, Illinois.

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